Sub. Spec. #10A (NE)

IN THE SPECIFICATION

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~~PROCESS AND PLANT FOR HANDLING THERMOFORMED OBJECTS FOR A SINGLE-STATION THERMOFORMING MACHINE WITH FORM AND CUT MOULD~~

Background of the invention

The present invention concerns a process and a plant for handling thermoformed objects particularly for a single-station thermoforming machine with form and cut mould.

In the thermoforming field of hollow packaging objects, and in particular for objects of relatively low height and medium or large dimensions, such as lids or containers , for example round and rectangular plates, tubs and the like, it is becoming of crucial importance for the manufacturer to be able to supply the market with thermoformed products, which have been correctly stacked, in perfect axial arrangement and easily de-stackable or removable from the stack. This necessity is increasingly important as the growth of the automatic product packaging sector continues. This means that the stacks of thermoformed products are usually destined to feed an automatic packaging machine and, if the stacks have defects in their axial arrangement or the products in their stacks do not have a constant and uniform index between them, or one or more thermoformed products is stuck in the next or previous container in the stack, impeding or making the separation difficult, the packaging machine stops and needs an operator to intervene, with consequent down time, increase of waste and then packaging costs.

To resolve this problem and in a particular that one of the hollow thermoformed

products' reciprocal sticking, it has already been suggested to provide undercut recesses (b) in hollow thermoformed products (a) on the rim or on the wall or lateral walls (c) or on the base (f) of the thermoformed products (see Fig. 1 of attached drawings), such recesses being obtained by providing corresponding fixed or mobile undercutting lugs or projections in the thermoforming mould.

However, if the recesses in the undercut recesses (b) on the side wall or walls are too prominent, the extraction of the thermoformed product from the thermoformed mould becomes difficult; if, instead, they are not very prominent, they are unable to prevent the stacked thermoformed products sticking to each other.

On the other hand, it is difficult, if not prohibitive, to constantly and precisely check a certain number of parameters, namely: thickness, density, fluidity grade etc., of a sheet or belt of thermoformable material in the mould of a thermoforming machine, and obtain therefore uniform and dimensionally perfect undercut recesses in the thermoformed containers.

The recesses obtained with mobile projections in the mould are very expensive to produce and to keep working efficiently. Experience has shown that the mobile projections in the mould frequently stop because of the inevitable dirtying due to the plastic material dust which always accrues in the form and cut mould of the thermoforming machine.

In any case, then, it is known that in stacks of hollow thermoformed products (a) with vibrations and shaking during transport or warehouse handling, the undercutting recesses (b), if not perfect, cause the thermoformed containers or lids making up the single stacks to stick.

For all these reasons, instead of obtaining stacks axially aligned and with thermoformed products (a) kept distant a uniform distance (d) as shown in Fig. 1, uneven stacks ~~and~~ are formed with thermoformed products (a) arranged roughly and therefore not uniformly distanced from one to the other (Fig 2), in as much as the thermoformed products (a) are inevitably subject to sticking to each other, which makes it ~~separating them~~ difficult, if not impossible, to de-stack or separate ~~when used~~ them before use. Clearly, a stack of thermoformed products (a) not perfectly aligned in an axial direction and with products (a) that are difficult to de-stack, cannot

be used in automatic distribution machines or in automatic filling lines for thermoformed containers.

The same problems occur with the undercutting projections (b) when they are provided on the base (f) of thermoformed products, ~~when~~ since the projections often stick to each other with the result that the product stacks are defective, as shown in Fig. 3 of the drawings.

Summary of the invention

The main object of the present invention is to provide a process and a handling and stacking plant for a plurality of thermoformed objects that can eliminate the difficulties mentioned above with the technical solutions ~~mentioned above~~ available in the state of art.

According to a first aspect of the present invention there is provided a process for handling and stacking a plurality of thermoformed objects ~~containers or lids~~, which is characterized in that it comprises the following sequential phases:

- obtaining ~~during a thermoforming phase~~ thermoformed objects or mouldings of thermoformed objects each formed with ~~lids and containers, having~~ at least three stacking protrusions or spacers, ~~all~~ having the same space arrangement in each ~~all the~~ thermoformed object ~~products~~ of the same moulding, at least one ~~of the~~ stacking protrusion~~s~~ or spacer~~s~~ of a same thermoformed object being located ~~set out~~ in a non specular symmetric way with respect to at least a centre line of the respective thermoformed object ~~container or lid~~ and at a distance from the same centre line ~~of the respective container or lid~~ different from that of the other~~s~~ protrusions or spacers,
- arranging one thermoformed object or a moulding of said thermoformed objects ~~containers or lids~~ in at least one support template to keep them in order according to the spatial arrangement that they had during the thermoforming phase,
- turning through a predetermined angle around a vertical axis every other thermoformed object or moulding of thermoformed objects ~~either containers or lids~~ before or during their transfer to a stacking station, and
- stacking thermoformed objects or mouldings of thermoformed objects ~~containers or lids~~ with alternate objects or mouldings turned through said predetermined angle, ~~so~~

~~as to~~ to obtain stacks of objects ~~containers or lids~~, where the stacking protrusions of an object ~~container or lid~~ are offset with respect to those of the next object ~~container or lid~~ in each stack.

According to another aspect of this invention there is provided a plant for handling and stacking thermoformed objects ~~containers or lids~~ having at least three projections acting as stacking spacers, at least one of which is arranged at non specular symmetry with respect to at least a centre line of the respective object ~~container or lid~~, said plant including, in sequence, a receiving station for a thermoformed object ~~container or lid or~~ a moulding of thermoformed objects ~~containers or lids~~, at least ~~a~~ one stacking or working station for said cthermoformed objects ~~ontainers or lid~~ , a stacking station for said thermoformed objects, ~~containers or lids~~, means ~~of~~for transferring the thermoformed objects ~~containers or lids~~ from the receiving station to the stacking station through each working or handling station, ~~and is characterized in that~~ wherein at least one of the said handling stations includes handling means arranged to rotate through a predetermined angle about a vertical axis every other moulding of thermoformed objects ~~containers or lids~~ before or during their transfer to said stacking station, thereby obtaining stacks of thermoformed objects lids or containers, where the stacking spacers of an object container or lid are angularly offset with respect to those of the next object ~~container or lid~~.

Advantageously, the transfer devices include a step rotating conveye~~o~~r.

Brief description of the drawings

Further aspects and advantages of the present invention will become clearer in the following detailed description of some currently preferred embodiments of handling and stacking plants, given by way of non limiting examples with reference to the accompanying drawings, in which :

Figures 1 and 2 show a partial cross section view of a stack of thermoformed products with stacking recesses on side walls according to the prior art;

Figure 3 show a partial view in cross section of a stack of thermoformed products with undercutting recesses on the base of the products according to the prior art;

Figure 4 is a schematic front view, slightly from above of a handling and stacking plant according to the present invention installed downstream of a single station thermoforming machine with form and cut mould;

Figure 4a shows a detail of Fig. 4;

Figure 4b shows a variant of Fig 4, in which a thermoformed product is deposited, after having been partially turned, on a thermoformed object that has not been turned;

Figure 4c shows a detail of a stacking station in Fig. 1;

Figure 5 is a schematic front view of two containers, one on top of the other, and turned 180° one to the other before their reciprocal stacking;

Figures 6 and 7 show each a partial cross section of thermoformed objects provided with stacking spacers on the base thereof and stacked according to the process of the present invention;

Figure 8 is a ~~is a~~ partial cross section view of thermoformed objects provided with stacking spacers on the rim thereof and stacked according to the process of the present invention;

Figure 9 shows a partial cross-section of two stacked containers ~~with~~ having an intermediate level arranged between base and rim thereof and provided with stacking spacers;

Fig. 10 is a schematic front view, slightly from above, of a second embodiment of the handling and stacking plant according to the present invention installed downstream of a single station thermoforming machine with from and cut mould;

Figure 11 shows a detail on an enlarged scale and a cross section taken along the line XI –XI of Fig. 10;

Figure 12 shows a schematic front view, slightly from above a third embodiment of a handling and stacking plant according to the present invention; and

Fig. 13 shows a variant of the plant in Fig. 12.

In the accompanying drawings similar or same parts or components have been identified with the same reference numerals.

Description of the preferred embodiments

With reference first to all Figures 4 to 9, it will be seen that a plant 1, according to the present invention, for handling and stacking thermoformed containers or lids (hereinafter called thermoformed objects or products) 2 comprises, in sequence, a station 3 for receiving or loading a moulding of products 2 (i.e. a group of objects thermoformed together in, and picked up together from the same mould), a step conveyoer 5, of the carousel type, a handling station or handling device 6 downstream of the receiving station 3 and designed to cause the alternate moulding of products 2 to rotate through a predetermined angle, and a stacking station 4 for containers and iids 2.

Each thermoformed product 2 (for example, a rectangular tub, as shown in Figs 5 and 7 to 9 or a cup as shown in Fig 6) is produced in a thermoforming machine or press 31 with form and cut mould 32 and with two couples 8a and 8b of stacking spacers or projections on the base or the rim of the thermoformed product 2 or on a surrounding level between base and rum rim. A couple of spacers 8a are arranged at a distance from the transversal centre line m-m of the respective container 2 not specularly symmetrical with respect to another couple 8b, so that, thanks to the alternate rotation of the product mouldings 2 (as will be further explained below), it is possible to obtain stacks 7 of products 2, in which the couples of stacking spacers 8a and 8b of a thermoformed product 2 are offset with respect to those of the product which follow it or precede in the stack (see Figs. 5 to 9 in the drawings).

The thermoforming press 31 has a lifting plate 30, for example of the suction type, which picks up the thermoformed products 2 from the mould 32 of the thermoforming press 31 and deposits them on a template frame 9a-12a of the rotating conveyer 5 positioned in the receiving station 3.

The carousel conveyer 5 has, e.g. four spokes 9,10,11,12 all extending at right angles to each other, all and terminating with their own a respective template frame 9a, 10a, 11a and 12a .The template frames are arranged on the same plane and at the same distance from a vertical axis x-x of common rotation, e.g. in the direction as indicated by an arrow A. The four spokes 9-12 are preferably integral ted with a central plate 13, in turn supported by, and rotatably e mounted in by a framework or central mounting 14, in which preferably there is an electric step motor 14a for constant step

rotation of the conveyer is also mounted.

The handling station or handling device 6 comprises a support structure, an overhanging arm 15 having one end ~~fixed~~ secured to a fixed support 16, while its other end supports a head or ~~a real~~ handling device 17 which can rotate about a vertical axis and be raised and lowered. ~~To be able to make the raising and lowering movements for the head 17, various methods can be adopted~~ Various methods can be adopted for rising and lowering the head 17, e.g. in Fig. 4 the arm 15 is slidably mounted on the support 16 along a couple of vertical guides 16a and is controlled to carry out raising or lowering movements by a screw-nut thread group 16b and controlled by a reversible electric motor 16c.

Handling device 17 on the free end of the arm ~~16~~ 15 comprises e.g. an electric motor – gearbox unit 18 fixed with vertical axis through a passing opening in the arm 15, a plate 19 rotatable around a vertical axis and supported underneath the motor-gear unit 18, and a multiplicity of tubular spacers 20 facing downwards and having their upper end fixed to the lower face ~~off~~ of the turning plate 19, while their lower end supports ~~at their lower end~~ a suction block. The reciprocal distancing of the blocks or suckers 21 is equal ~~to homothetic~~ to that of the receiving openings of the thermoformed products 2 ~~foreseen~~ provided in each template or template frame 9a –12a, so that when the handling device is lowered by the motor 16c on a template, the blocks or suckers 21 go to rest and engage the base of the thermoformed products 2 carried by the templates. Each block or sucker 21, through its spacer 20 and suitable tubing, e.g. in the turning plate 19, can be connected through pilot valves, for example, controlled by a programmable ~~command~~ control unit 25, with a vacuum source (not shown in drawings) of any suitable type.

As illustrated in Figure 4b, once the handling group 17 has removed the thermoformed products 2 from a template 9a-12a and has carried out a predetermined angular movement, the turned thermoformed products 2 can be positioned directly on the template from which they have been taken or on the template which follows immediately and is loaded with thermoformed products 2 which have not been turned.

The stacking station 4 can be of any suitable type, e.g. the type with a lower

platen 26 which supports a plurality of pushing devices 27, which push upwards from underneath the moulding of products 2 brought for example ~~from~~ by the template frame 12a once it has reached a correct position above the platen ~~27~~ 26, and an upper fixed ~~platen~~ frame 28 on which stacks 7 of thermoformed products 2 are formed and ~~stacked~~ supported in a manner well known in the art as shown in Fig. 4c. The resulting stacks 7 are formed by thermoformed objects 2, which having been turned through 180° in alternate mouldings by the handling group17 are stacked as shown in Figures 6 to 9 , i.e. with a couple of stacking protrusions 8a of one container arranged above, but offset so as not to interfere with the couple of stacking protrusions 8b of the lower container. Thanks to this reciprocal misalignment of the stacking protrusions, it is possible to completely avoid having the protrusions, and therefore the products 2, stick one inside the other, thereby constantly obtaining stacks 7 of thermoformed products 2 always axially aligned and, therefore, always positioned perfectly even during transport and handling after stacking.

Figures 8 and 9 show in detail stacking protrusions 8a and 8b, which are provided in the flat rim or flange 2a of each thermoformed product 2 or at a surrounding level 2b positioned between the base and the free rim of the containers 2.

Figure 10 shows a variant of the embodiment shown in Fig. 4. In the rotating conveye~~o~~r 5 the arms or spokes from 9 to 12 terminate with a respective circular support frame, respectively 39, 40, 41 and 42, within which a respective template 9a-12a is supported and can be rotated. In particular , each arm 9-12 supports at the circular supporting frame (as better seen in Fig. 11) an electric motor 46 with a vertical axis, on whose output shaft 46a a pinion 44 is keyed which meshes with a circular rack or a length of circular rack 43 integral in rotation with the respective template, for example 9a. The template 9a is preferably rotatably supported on a respective template frame 39-42 by at least three radial pins 9b-12b (only pin 9b being visible in the drawings) which are mounted on a respective ball bearing 9c-12c and guided by bearings 9d-12d on a vertical axis which roll on the internal wall of the respective circular frame 39-42.

In use, during transfer from the receiving station 3 or during the stop at the

handling station 6, the motor of the arm 9-12 concerned is energized by a program control unit 25, so as to cause a partial rotation, for example through 180°, of every other template 9a-12a loaded with thermoformed products 2, so as to obtain stacks 7 of thermoformed products 2 at the stacking station 4, as shown in Figures 6 to 9.

If desired, the handling device 7, after having caused a moulding of thermoformed products 2 picked up from a template 9a-12a in the handling station 6 partly to rotate, can load the turned moulding on a successive template already loaded with thermoformed products 2, not turned , and thus the turned products 2 are pre-stacked (see Fig.4a), which enables the number of cycles in the time unit to be increased.

In the embodiment of a plant according to the present invention shown in Fig 12 there is shown a linear conveyeor 50 for templates 51, e.g. of the type having an upper forward run and a lower return run and a step drive motor 52.

At a position upstream of the upper forward run there is provided a receiving station 3, where the thermoformed products 2 are loaded by the pick up plate 30 in the template 51 which at that moment is waiting in the receiving station 3. In an intermediate position downstream of the receiving station , there is provided a rotating station arranged to cause every other template 51 to rotate through a predetermined angle, such a rotation being carried out by a handling device 17, e.g. one similar to that shown in Fig. 4. At the end of the upper forward run there is provided a stacking station 4, e.g. a stacking station as that described with reference to Fig. 4, where the thermoformed products 2 are stacked alternately turned to obtain stacks 7 as illustrated in Figures 6 to 9.

Figure 13 shows a variant of the plant of Fig. 12, in which the handling device is a robot structure 60, which carries out the rotation of a moulding of thermoformed products 2 transported on a template conveyeor 50 and can also carry out , upon control of a control unit 25 , the picking up of sample mouldings of products 2 to transfer them , for example onto a template 71 on a second conveyeor 70 nearby, in order to be tested or transferred to a second handling or stacking line.

To this end, the robot 60 can have a telescopic arm 15, that can oscillate around a horizontal axis and turn around a vertical axis. Additionally, the robot 60 can

move, e.g. in a parallel fashion to the conveyeor 50, for example to position a moulding of thermoformed products 2 on the conveyer 50 in a different position to that of the picking up, owing to a reversible drive motor 61 that, e.g. through a gear unit, causes a drive screw 62 to rotate, which engages in a nut screw 63 secured to, or integral with, the base 64 of the robot. Advantageously, the base 64 can slide along straight guides 65 which extend parallel to the control screw 62.

The above described plant is subject to numerous modifications and variations within the scope of the claims.

For example, in the embodiment illustrated in Fig. 10, the partial rotation movement of the templates 9a-12a can also be directly derived from the motion of rotation of the conveyeor 5 by using a suitable transmission system.

The disclosure in the Italian patent application no.VR2001A00016 filed on February 15, 2001 from which priority is claimed is incorporated herein by reference. Any reference sign following technical features in any claim has been provided to increase intelligibility of the claim and shall not be construed as limiting the scope of the claim.